Indonesia - Green Prosperity: Community-Based Off-Grid Renewable Energy Grant Portfolio

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Overview

Identification

COUNTRY
Indonesia

EVALUATION TITLE
Green Prosperity: Community-Based Off-Grid Renewable Energy Grant Portfolio

TRANSLATED TITLE
N/a

EVALUATION TYPE
Independent Evaluation

ID NUMBER
DDI-MCC-IDN-GP-OFFGRID-2018-v01

Version

VERSION DESCRIPTION
Final, public version of the Baseline Evaluation Report

Overview

ABSTRACT
Taken as a whole, this evaluation aims, to the extent possible, to validate the program logic underlying the portfolio of community-based off-grid renewable energy grants in the Green Prosperity Grant Facility, doing so through a focused investigation of two specific grants: W3A Akuo Energy Solar/Micro-Hydro, Berau and W3A Anekatek Solar, East Sumba. It simultaneously aims to measure impacts and compare and contrast how the grants operate, both in terms of how similar programs operate in different contexts within Indonesia and in terms of how programs with different approaches to electrification and community engagement operate. It chiefly investigates changes in energy consumption, energy expenditure, economic opportunity, and greenhouse gas emissions as a result of exposure to a solar photovoltaic (PV) micro-grid that is owned and operated by a community-level Special Purpose Vehicle in treatment villages and sub-villages of the East Sumba and Berau regencies. This report describes baseline conditions of these outcomes of interest and assesses the validity of the project logic in the context of these conditions.To do so it will employ a quasi-experimental methodology in East Sumba combining statistical matching and difference-in-difference analysis techniques as well as non-experimental quantitative and qualitative pre/post performance evaluation methodologies in both East Sumba and Berau.

At baseline, we find the use of solar technology (typically 20 watts or less) more prevalent in East Sumba than in Berau, where individual or shared generators are often used. Although households in East Sumba have access to electricity for more of the day (9.2 vs. 5.3 hours), households in East Sumba consume significantly more diesel and gasoline and have more electric lighting fixtures lit per hour than are lit in East Sumba, such that each regency consumes around 27 lamp-hours per day of electric lighting. Households in Berau spend more on energy absolutely and as a percent of total income, although they are over twice as wealthy on average as households in East Sumba. Our findings lend support to the notion that access to the micro-grids is likely to increase the consumption of energy and decrease expenditure, although the latter outcome is more likely in places like Berau where baseline fuel consumption and expenditure is high than in East Sumba, where it is already low. The validity of this assumption will depend on the increase in electrical capacity from access to the micro-grid relative to other solar sources (between 400 and 900 watts at minimum depending on the regency) allowing households to substitute away from diesel-powered generators, which they currently must use to supplement low-capacity solar home systems.

We find that, with respect to increased economic opportunity, although local enterprises are keen to utilize newly available renewable energy for marginal improvements to their businesses, primarily local economies in each site are likely to preclude any more than marginal changes in economic outcomes of interest such as occupational income, income from transformed agricultural products, and time spent on income generating activity. With respect to greenhouse gas emissions,

we find baseline emissions to total 41.00 tons CO2e/month in East Sumba and 44.08 tons CO2e/month in Berau after accounting for diesel, gasoline, and kerosene consumed per month by each household in treatment areas and additional diesel contributed to communities in-kind for community generators from nearby extractive industry corporate social responsibility programs. Similar to energy expenditures, there is more potential for this figure to decrease in Berau, where fuel consumption is high at baseline, than in East Sumba, where fuel consumption per household is already low.

Finally, we assessed the potential for the SPV approach to render the projects sustainable over the long-term. To this end, we find strong community and grantee engagement and capacity for local governance to reflect positively on the potential for sustainability, although there is concern by many stakeholders that the grantees may not remain engaged long enough to transfer the necessary human capacity to villagers for operation and maintenance of the SPV and the micro-grid. Future data collection efforts will observe how the SPV interacts with obstacles and how engaged the respective parties remain.

To assess the validity of our own experimental design in the context of our baseline data, we re-ran our power analysis with our primary data, assessed our treatment and control groups for balance, and conducted a preliminary matching exercise. We find that, barring significant losses from contamination or pruning, we retain sufficient power to detect outcomes of interest. Treatment and comparison groups differ on key covariates, specifically related to wealth and remoteness, but they are equivalent even prior to matching on outcomes of interest such as energy access and electric lighting consumption. Matching techniques are able to eliminate as many as 1/3 of the significant differences detected. Although remaining differences and potential contamination remain risks to our experimental design, these should be mitigated by difference-in-difference analysis techniques and oversampling of control households.

EVALUATION METHODOLOGY
Pre-Post with Comparison Population, Pre-Post, Propensity Score Matching

UNITS OF ANALYSIS
Households, enterprises

KIND OF DATA
Other

TOPICS

Topic	Vocabulary	URI
Energy	MCC Sector	

KEYWORDS
Rural electrification, Renewable energy, Impact evaluation, Mixed methods, Community-based, off grid, Solar PV, Green Prosperity, Indonesia, Grant Facility, Propensity Score Matching, Berau, Sumba, SPV, Special Purpose Vehicle, Greenhouse gas, micro-grid

Coverage

GEOGRAPHIC COVERAGE
Rural villages and sub-villages within the regencies of Berau, East Kalimantan and East Sumba, East Nusa Tenggara.

UNIVERSE
At baseline, the universe is constructed of households and enterprises connected to the 11 kampung-level micro-grids that will be constructed in East Sumba and the 3 village-level micro-grids that will be constructed in Berau. At future data collection points, this universe may expand to treatment populations of other CBOG RE grants.

Producers and Sponsors

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FUNDING

Name	Abbreviation	Role
Millennium Challenge Corporation	MCC	

Metadata Production

METADATA PRODUCED BY

Name	Abbreviation	Affiliation	Role
Millennium Challenge Corporation	MCC		Review of Metadata

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MCC Compact and Program

COMPACT OR THRESHOLD
Indonesia Compact

MCC SECTOR
Energy (Energy)

Sampling

Study Population

At baseline, the universe is constructed of households and enterprises connected to the 11 kampung-level micro-grids that will be constructed in East Sumba and the 3 village-level micro-grids that will be constructed in Berau. At future data collection points, this universe may expand to treatment populations of other CBOG RE grants.

Sampling Procedure

The quantitative portion of the evaluation will take a clustered approach, where individual sample units include households that are clustered into either "settlement aggregations" in East Sumba or villages/desa in Berau. For the most part, the settlement aggregations in East Sumba are sub-village units sometimes referred to as kampungs. Occasionally, a settlement aggregation will encompass a whole village.

For the evaluation of W3A Anekatek Solar, East Sumba, we will use a random sampling strategy from the sample frame in treatment areas where settlement aggregations include over 30 households. Where settlement aggregations include fewer than 30 households, replacement households will be selected randomly from other treatment settlement aggregations. The sample in East Sumba will include approximately 840 households (330 treatment and 510 comparison) clustered into 11 treatment settlement aggregations and up to 17 comparison settlement aggregations.

Since treatment units have already been selected by the grantee in East Sumba, the sample frame for W3A Anekatek Solar, East Sumba includes all households in all eleven treatment settlement aggregations. For the comparison group, the sample frame includes all settlement aggregations in East Sumba that satisfy the following conditions:
1.) The Network Planner Activity of ADB TA 8287 indicated that the settlement aggregation was best suited for electrification via micro-grid;
2.) The settlement aggregation does not include households that are currently connected to the PLN grid; and
3.) The settlement aggregation is not currently targeted by PLN for electrification until after September of 2018.

From this sample frame and in the absence of any other data to assess comparability, we will select the 17 closest settlement aggregations to the treatment kampungs under the assumption that these are likely to be more comparable than kampungs that are further away. We will pursue the same random sampling techniques to select households within these settlement aggregations as was used in treatment areas, including replacement for settlement aggregations with fewer than 30 ohuseholds.

For W3A Akuo Energy Solar/Micro-Hydro, Berau, households will be sampled using a simple stratified random sampling technique. The strata will include the three treatment villages, and 50 households will be selected randomly from each village. The sample in Berau will include approximately 150 households clustered into 3 treatment villages.

The sample frame for household data collection in Berau will include all households that will be connected to the solar or micro-hydro micro grid. This includes 463 households among three villages. We will obtain this sample frame by requesting a list of treatment households from the grantee.

Deviations from Sample Design

Not applicable.

Response Rate

These metadata describe the design of an evaluation and do not present results, thus, this input will not be relevant until the presentation of baseline findings.

Weighting

We only apply a simple sample weight to our descriptive household-level statistics in order to account for the fact that the sampled kampungs/villages are represented close to evenly in our sample despite being very different sizes. Our weight is

constructed by dividing the population of households in a given kampung or village by the households sampled from that kampung or village. The minimum value of the weight is one (all households in the kampung/village were sampled), with the weight increasing for larger kampungs/villages with fewer sampled households. To get descriptive statistics at the regency level, the value of a given variable for a given household is multiplied by this weight before the mean value of the variable is reported.

Questionnaires

Overview

The evaluation consists of a quantitative household survey administered at both grant sites (W3A Akuo Energy Solar/Micro-Hydro, Berau and W3A Anekatek Solar, East Sumba). The household survey covers all relevant dimensions of the household that might be affected by the new access to electricity or that might affect the adoption and usage of electricity. The socio-economic living conditions will be elicited ranging from background variables like age, household size, and educational status of adult members to variables that potentially change after electrification, for example employment status, educational investments of children and expenditures. A particular focus is on energy consumption and usage, i.e. different energy services, fuels, expenditures, and appliances. Moreover, the questionnaire probes into the activities related to energy usage, for example activities after nightfall, TV usage and appliances. Attention is dedicated to income generating activities.

Additionally, semi-structured protocols will be held with the chief of the respective sub-villages or a sub-village member with good knowledge on the population and village dynamics. The protocol comprises modules on basic sub-village information, availability and quality of infrastructure and services, energy access and use patterns, and detailed sections on income generation in the sub-village.

Similarly, semi-structured interviews will be held with all microenterprises of the sub-village. In case of large enterprise numbers, a non-random sample will be chosen, which includes all different types of enterprises, for example welders, bakers, shop owners, or carpenters. The protocol includes modules on basic enterprise and customer information, energy use and production processes, and employment patterns. It is designed to capture growth potentials of the enterprise, which might be unlocked by electricity access.

The questionnaires were developed in English with key inputs from the evaluation's Renewable Energy Analysts, who used sectoral expertise to inform questionnaire structure and content.

Data Collection

Data Collection Dates

Start	End	Cycle
2017-09-18	2017-10-05	Qualitative baseline data collection
2017-10-23	2017-11-30	Quantitative baseline data collection

Data Collection Mode

Household survey, enterprise survey, village official survey, beneficiary focus group discussion, enterprise key informant interview, village official key informant interview

Data Collection Notes

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Data Collectors

Name	Abbreviation	Affiliation
Jasa Layan Risetindo	JRI Research	

Supervision

The evaluation team is comprised of qualitative and quantitative field teams and support staff at Social Impact headquarters in Arlington, Virginia. The Principal Investigator is responsible for technical oversight and senior-level evaluation expertise. The qualitative staff is comprised of Senior and Junior Renewable Energy Analysts, who provide inputs on sector-appropriate evaluation design and instrumentation, as well as two-locally based Research Assistants who will assist in administration, translation, and transcription of qualitative interviews. The qualitative field team is comprised of the PI, HQ-based Research Assistant, external Senior Analyst, and two local Research Assistants who will collaborate on the execution of the quantitative sampling strategy and administration of quantitative tools. HQ-based staff are responsible for day to day management and will contribute to data analysis and reporting, delegating activities as necessary.

As these metadata pertain to field operations during enumeration, they describe the design of an evaluation and do not present results, thus, this input will not be relevant until the presentation of baseline findings.

Data Processing

Data Editing

These metadata describe the design of an evaluation and do not present results, thus, this input will not be relevant until the presentation of baseline findings.

Other Processing

These metadata describe the design of an evaluation and do not present results, thus, this input will not be relevant until the presentation of baseline findings.

Data Appraisal

Estimates of Sampling Error

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